University of Maryland at College Park

Final Report
Grant NAG5 866
P.I.s – F. Baer and Y. Mintz

We considered the influence of land surface roughness on the large scale atmospheric circulation and rainfall by comparing three sets of simulations made with a general circulation model in which the land surface roughness length, z_0, was reduced. This produced about a two–fold increase in the boundary layer wind speed, a two–fold decrease in the magnitude of the surface stress, but almost no change in the surface evaporation and surface sensible heat flux. Additionally, a large change in the horizontal convergence of the water vapor transport in the boundary layer and a corresponding large change in the rainfall distribution was noted suggesting that the height of the earth's vegetation cover, has a large influence on the boundary layer water vapor transport convergence and the rainfall distribution.

Ensemble sets of four July and four January simulations were made with the GLA GCM. Each set contains two runs: one with and one without SiB. SiB calculates the land surface fluxes of heat, moisture and momentum, as well as the near surface fluxes of shortwave and longwave radiation with an explicit parameterization of the interactions among atmosphere, vegetation and soil processes. The results of SiB vis–a–vis no SiB comparison show that SiB simulates much lower evapotranspiration rates over land and generates significantly different values of surface fluxes for both vegetated and bare soil regions. These differences in the surface fluxes are accompanied by large and statistically significant changes in the simulated rainfall, particularly in the tropics and the summer hemisphere. An analysis of the monthly mean diurnal cycle of surface fluxes shows that both the surface fluxes and rainfall values for the SiB–GCM are realistic in different regions: densely vegetated sparsely vegetated and bare soil (including dry deserts). It is evident that the SiB provides a better estimate of the surface fluxes on the whole, leading to improvements of the simulated circulaiton and rainfall climatology of the Earth.

Relevant Publications:

Sud, Y. C., P. J. Sellers and Y. Mintz, 1986: A Simple Biosphere for Use in General Circulation Model, *J. Atmos. Sci.*, **43**, 505–531.

Sud, Y. C., J. Shukla and Y. Mintz, 1988: Influence of Land Surface Roughness on Atmospheric Circulation and Rainfall: A Sensitivity Study with a General Circulation Model, *JAM*, **27**, 1036–1054.

Sud, Y. C., P. J. Sellers, Y. Mintz, M. D: Chou, G. K. Walker and W. E. Smith, 1990: Influence of the Biosphere on the Global Circulation and Hydrologic Cycle– a GCM Simulation Experiment, *Agriculture and Forest Meteorology*, 133–180.